Better Asthma Management with Advanced Technology
Creation of an Asthma Utilization Rx Analyzer (AURA) Tool

James H. Jackson, PharmD, MPH; Benjamin Gutierrez, PhD;
Orsolya E. Lunacsek, PhD, MBA; and Sulabha Ramachandran, PhD

ABSTRACT

With nearly 23 million people affected by asthma each year, optimizing care among patients with persistent disease is a constant challenge for health care providers. The Asthma Utilization Rx Analyzer (AURA) tool enables health plan managers to evaluate quality and resource utilization for its members with asthma by analyzing medical and pharmacy claims. Customizable quality measures allow users of the tool to generate results from specific plans in order to optimize asthma disease management.

INTRODUCTION

As one of the most prevalent chronic diseases in the U.S., asthma affects approximately 23 million people each year; the prevalence rate is 7.3% in adults and 9.4% in children.[1,2] Over the past two decades, the prevalence of asthma has increased, accounting for approximately 13 million physician office visits, 1.8 million hospital emergency visits, and close to 500,000 hospitalizations annually in the U.S.[3–5] Asthma causes almost 12.8 million missed school days in children and 14.5 million lost work days in adults each year.[3,5]

The annual economic burden associated with asthma is approximately $19.7 billion in health care costs, with prescription drugs as the major cost driver of direct medical expenditures.[3,4] Because of the significant health, social, and economic costs of asthma, the need to improve therapeutic outcomes through better disease management has become the focus of paramount importance in recent years.

In an ongoing effort to improve the care of patients with asthma, the National Asthma Education and Prevention Program of the National Heart, Lung, and Blood Institute (NHLBI) recently updated evidence-based treatment guidelines to assist health care providers in delivering optimal disease management.[6] In addition, technical specifications of the Healthcare Effectiveness Data and Information Set (HEDIS) included a measure for the appropriate use of asthma medications in health plans in accordance with the guidelines. This HEDIS measure is used to evaluate the percentage of patients (5 to 56 years of age) with persistent asthma who received appropriate drug therapy for long-term asthma control.[7] The proportion of identified health plan members meeting this metric improved from 57.7% in 1998 to 89.9% in 2005 and to 91.6% in 2006.[8]

Dr. Jackson is Senior Director and Dr. Lunacsek is Assistant Director, both at Xcenda in Palm Harbor, Florida. Dr. Gutierrez is Director of Health Economics and Outcomes Research, and Dr. Ramachandran is Associate Director of Health Economics and Outcomes Research, both at AstraZeneca LP in Wilmington, Delaware.

Although asthma care has improved considerably, more still needs to be done. In the U.S. in 2006 alone, asthma accounted for 14 million missed school days for children and 14.5 million sick days for adults, amounting to $4.6 billion in lost productivity.[8] Clearly, new strategies and quality measurements are needed for continued improvements.

RATIONALE FOR NEW TECHNOLOGY DEVELOPMENT

Asthma management can be challenging and complex because of the diversity of the patient population, the lack of a clear correlation between disease severity and outcomes, the inherent variability and temporal aspects of the disease, and the problem of patient adherence to therapy.[9] Although the premise of HEDIS is focused on improving the delivery of quality health care, health plans are constantly faced with the challenges of understanding and identifying quality improvement opportunities in the disease-management process.

Measuring the use of controller and rescue medications and the consumption of other medical resources can provide critical information about the management of asthmatic patients in health plans. Because the approach to care should be managed at multiple levels, the ability to understand health plan utilization (e.g., use of controller medications, medical and pharmacy costs), patients' use of resources (e.g., medication use, the need for acute care), and physician performance (e.g., prescribing habits, patient care outcome performance), is valuable to managed care organizations (MCOs). Collectively, this information can be used to identify ways of improving treatment. The ability to compare plan-specific utilization criteria with national or regional performance benchmarks may provide a comprehensive approach to improving asthma care.

Many MCOs and physician organizations do not have the internal resources available to analyze these performance measures. Consequently, a tool for asthma management was developed to support quality improvement initiatives and to enhance appropriate asthma medication usage among adults and children.

AURA

AURA is a software tool that can be used by health plans to analyze their health care claims data in order to manage medication use and quality of care for their members with asthma.[10] AURA is designed to examine patterns and costs of asthma medication and health care resource use within a health plan's population at a defined period (i.e., a cross-sectional analysis). Evaluations can then be repeated at subsequent time periods to assess long-term trends.

Asthma Utilization Rx Analyzer (AURA) Tool

Because repeated measurements are necessary in ongoing quality programs, AURA incorporates and automates utilization measure criteria (UMC) in its system to increase efficiency in data analysis.

AURA also offers flexibility by providing users with options throughout the tool. Users have the choice to analyze all patients or to evaluate specific patient subpopulations, such as patients with persistent or non-persistent asthma, and pediatric or adult patients. In addition, users have the option to analyze all available measures or to pick and choose specific ones. For many of the measures, users can further customize the tool by selecting a preferred definition from a list of available options.

For benchmarking, AURA includes a pre-loaded default reference set of results based on data from PharMetrics (Watertown, Mass.), an integrated national claims database. PharMetrics is composed of more than 85 managed health care plans encompassing 45 million members. In addition to the pre-loaded default reference, AURA users can create and store up to three plan-specific references within the tool to track their plan's quality metrics over time.

Approach to AURA Development and Methodology

A five-step process was used to develop AURA:

- a literature review
- development of UMC
- software design
- validation testing
- pilot testing

First, we conducted a literature search and review to obtain and assimilate key asthma-related guidelines, quality metrics, benchmark reports, posters, publications, and presentations. We reviewed publications from the American Lung Association (ALA); the National Center for Health Statistics; the Centers for Disease Control and Prevention (CDC); the National Heart, Lung and Blood Institute; the National Committee for Quality Assurance (NCQA); and the American Academy of Allergy, Asthma, and Immunology (AAAAI).

The rationale for AURA emerged from ALA[3] and AAAAI.[11] We consulted numerous additional publications to establish the criteria for defining persistent asthma within AURA.[12–17] As a result of the varying criteria found in the literature, the tool was designed to enable users to choose any one or a combination of four customizable criteria adopted from NCQA.[7] Findings from the literature were also used to define comorbid conditions of interest,[12,13,18–22] drug compliance measures,[14,16,17,19–21] and the utilization of asthma-related resources, including hospitalizations, emergency department visits, and use of oral corticosteroids and short-acting beta-agonists (SABAs).[14,16,19–23]

From this information, we compiled a list of asthma-related measures of interest and their proposed definitions in the outline of the UMC document. We then used a national health plan claims database (PharMetrics) to evaluate the asthma metrics and to test the feasibility of analyzing health plan claims data according to the UMC outline. After feasibility testing and measure refinement, the UMC document was created to briefly explain the purpose and content of the software tool and to pro-

vide detailed definitions for the selected asthma measures.

The software design phase began with the selection of a Microsoft.NET platform utilizing a database back-end to store and retrieve claims. An alpha version was developed with basic functionality and screen design, followed by a beta version with full functionality. Using the beta version, we conducted validation testing to ensure quality control and the accuracy, reliability, and validity of results. Validation testing included assessments of output and of the functionality of the tool itself. We tested the output results through a database analysis using SAS version 9.1 (Cary, N.C.). We evaluated software functionality through unit testing, system integration testing, and a formal quality assurance test. All identified errors and inconsistencies were tracked and resolved.

The last phase included pilot testing with the end-user. We selected a total of three sites: a Medicaid health plan, a commercial health plan, and a large provider organization. Each site utilized their own data to test the tool and provided feedback about the usefulness of the tool along with suggested enhancements. We recorded all feedback and updated the tool.

Specific Utilization Measure Criteria

Health plans are often evaluated based on benchmarks and are held accountable to asthma-reporting metrics. HEDIS, for example, contains a performance measure that focuses on asthma care.[7] In HEDIS, the quality of asthma care is measured based on the proportion of patients with persistent asthma who are receiving an appropriate long-term controller medication. AURA automates the process and extends the asthma-related reporting capability beyond controller medication use alone.

Table 1 Customizable Utilization Measures

Population overview
Patient demographics
Comorbid conditions
Asthma drugs with a non-asthma diagnosis
  (0 to 4 years of age)
Controller medications
Utilization by asthma severity
Average days' supply
Rescue medications
Use of short-acting beta-agonists
Use of pulse steroids
Compliance with controller medications
Use of controller medications by health plan members
  with persistent asthma by quarter
Average number of controller medication claims
  by quarter
Resource utilization
Emergency department visits
Hospitalization
Outpatient visits
Costs
Average asthma spending per member per month
Average asthma spending per member per month detail

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With AURA, pharmacy and medical claims data are imported, integrated, and analyzed in accordance with the user-defined customizable options and utilization measures (Table 1). Furthermore, the user can modify the definition of persistent asthma based on the number of emergency department visits, hospitalizations, outpatient visits, and medication-dispensing events. The results are then displayed concurrently according to persistent and non-persistent asthma in comparison with a reference data set (the option of either PharMetrics or a plan-specific reference). The following are examples of utilization measures available in the software tool.

Short-Acting Beta-Agonists and Steroids

Because rescue medications (SABAs, oral steroids) are typically used for managing acute asthma episodes rather than for long-term control, an increased use of these drugs generally indicates poor disease control. Inappropriate use of SABAs (i.e., more than four canisters per year) has been correlated with poor asthma control and with a risk of hospitalization.[23] The use of SABAs in AURA is calculated and is reported based on the number of patients with one to seven or more SABA claims. Details of the actual SABA medications used are provided for patients receiving seven or more SABA claims. Similarly, oral steroid use is reported based on the number of patients with at least one steroid pulse prescription claim and details of the actual medications used. All results are displayed in tabular and graphical formats.

Controller Medications

Along with the evaluation of rescue medications, patterns of controller medication use can indicate how well asthma is being managed within the health plan. Controller medications, such as inhaled corticosteroids, long-acting bronchodilators, leukotriene receptor antagonists, combination products, and mast-cell stabilizers, are shown by the percentage of use and by disease severity (persistent and non-persistent asthma). This figure is determined by using the number of claims for specific controller medications (by class, by drug, or by strength), divided by the total number of claims for controller medications. Among patients with persistent asthma, the total quarterly claims for the number and proportion of patients with at least one controller prescription and the average number of controller medications by quarter are also reported.

Emergency Visits, Outpatient Visits, and Hospital Stays

AURA provides the total number of asthma-related emergency department (ED) visits, outpatient visits, and inpatient hospitalizations, as defined by Current Procedural Terminology (CPT) codes and Uniform Billing (UB-92) revenue codes (Table 2). The presence of a diagnosis code for asthma (ICD-9 493.x) defines an asthma-related visit. The tool also reports the number of members with each visit type as well as the number of asthma-related pharmacy claims filled within specific time intervals (e.g., 1 to 30 days) prior to each visit type. The asthma-related pharmacy claims are further categorized by medication type (controller or rescue) and by therapeutic class and generic category. Results are presented for the two asthma severity subgroups (persistent and non-persistent).

Other Utilization Measure Criteria

AURA provides information about the cost of asthma for each health plan member per month as well as the average monthly cost for each plan member with a diagnosis of asthma according to medical and pharmacy claims. This cost information is depicted in summary format as well as on a monthly basis over time during the measurement period. Medical care costs (e.g., for hospitalization, emergency, or outpatient visits) and prescription costs are displayed in a tabular format.

AURA can produce measures of performance by targeting patients with high use of resources and physicians whose patients are less than optimally managed. By applying threshold definitions, the high use of medical resources (i.e., emergency or hospitalization events), high use of rescue medications, and low use of controller medications can be specified and assessed. AURA also reports identification numbers of prescribers along with the proportion of their patients who were above or below the specified threshold.

UTILITY AND APPLICATION OF AURA

Poorly controlled asthma treatment can lead to increased use of resources and increased costs of care. AURA helps in determining patterns of usage to identify ways to improve quality. The following examples demonstrate how the tool can

| Table 2 Codes for Identifying Type of Visit by Patients with Asthma*		
Description	**Current Procedural Terminology**	**Uniform Billing UB-92 Revenue Code**
Outpatient	99201–99205, 99211–9215, 99217–99220, 99241–99245, 99341–99345, 99347–99350, 99382–99386, 99392–99396, 99401–99404, 99411, 99412, 99420, 99429, 99499	051x, 052x, 057x–059x, 077x, 0982, 983
Acute inpatient	99221–99223, 99231–99233, 99238, 99239, 99251–99255, 99261–99263, 99291	010x, 0110-0114, 0119, 0120–0124, 0129, 0130–0134, 0139, 0140–0144, 0149, 0150–0154, 0159, 016x, 020x–022x, 072x, 0987
Emergency	99281–99285	045x, 0981
* HEDIS 2007, Vol 2. National Committee for Quality Assurance.[7]		

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Table 3 Example of Short-Acting Beta Agonist (SABA) Utilization Output*

Adult Population	Plan†			Reference‡		
	Total No. (%)	Persistent No. (%)	Non-Persistent No. (%)	Total No. (%)	Persistent No. (%)	Non-Persistent No. (%)
Members with asthma	15,799 (100%)	2,350 (100%)	13,449 (100%)	15,799 (100%)	2,350 (100%)	13,449 (100%)
Total members with 1 SABA claim	4,987 (32%)	528 (22%)	4,459 (33%)	4,987 (32%)	528 (22%)	4,459 (33%)
Total members with 2 SABA claims	1,300 (8%)	245 (10%)	1,055 (8%)	1,300 (8%)	245 (10%)	1,055 (8%)
Total members with 3 SABA claims	518 (3%)	142 (6%)	376 (3%)	518 (3%)	142 (6%)	376 (3%)
Total members with 4 SABA claims	320 (2%)	94 (4%)	226 (2%)	320 (2%)	94 (4%)	226 (2%)
Total members with 5 SABA claims	232 (1%)	81 (3%)	151 (1%)	232 (1%)	81 (3%)	151 (1%)
Total members with 6 SABA claims	133 (1%)	52 (2%)	81 (1%)	133 (1%)	52 (2%)	81 (1%)
Total members with 7 SABA claims	599 (4%)	273 (12%)	326 (2%)	599 (4%)	273 (12%)	326 (2%)
SABA Pharmacy Claims (7 or more claims)	6,623 (100%)	3,076 (100%)	3,457 (100%)	6,623 (100%)	3,076 (100%)	3,457 (100%)

Members with SABA Use

- Total members with 1 SABA claim
- Total members with 2 SABA claims
- Total members with 3 SABA claims
- Total members with 4 SABA claims
- Total members with 5 SABA claims
- Total members with 6 SABA claims
- Total members with 7 or more SABA claims
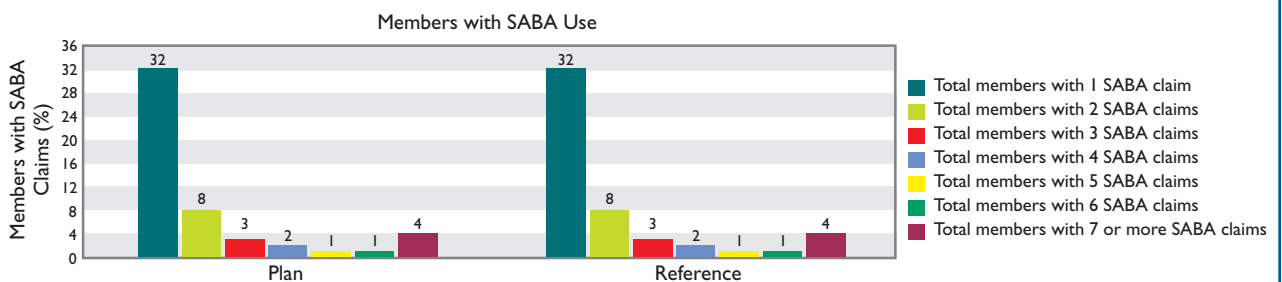
• The percentages above may not sum to 100% due to rounding of whole numbers.

* Patients are defined as having persistent or non-persistent asthma based upon HEDIS 2007, Vol 2. National Committee for Quality Assurance.[7]
† Plan = Plan-specific data uploaded by the managed care organization.
‡ Reference = PharMetrics data preloaded with the AURA tool.

be applied.

A greater use of rescue medications indicates the need for better management of persistent asthma through the use of controller medications. Because prescription claims for controller medications are categorized by disease severity and by the number of claims per patient, health plans can easily examine any usage patterns that are greater or lower than the benchmark reference.

For example, in Table 3, if a higher proportion of plan members are using SABAs relative to the PharMetrics reference, this may suggest that plan patients are not receiving appropriate therapy for long-term asthma control. Health plans can then evaluate whether controller medications are being underutilized, which may explain the frequent use of rescue agents.

Poor asthma control may also be reflected by high demand for medical care, such as outpatient or emergency visits or hospitalization. As shown in Table 4, AURA presents asthma-related emergency department utilization and medication use at various time intervals prior to the emergency department visit. If the proportion of plan members receiving appropriate controller treatment is low compared with the PharMetrics reference, several explanations may exist:

1. Patients are noncompliant with controller medications.
2. The controller medications used are not effective; perhaps the dose needs to be increased or the drug class needs to be changed.
3. Physicians might not be prescribing enough controller medications to help maximize asthma control in their patients.

In each scenario, the information is readily supplied by AURA to assess outcomes at the patient and prescriber levels. Health plans may then run a more targeted analysis that evaluates specific criteria for improvement. Such interventions may consist of patient education programs to improve compliance, continuing education programs for practicing physicians, or removing potential barriers to care.

HOW AURA IMPROVES QUALITY

Overall, incorporating these measures allows users of the AURA tool to identify potential trends and outcomes for quality improvement opportunities and to decrease the cost of care. AURA advances the collection and reporting of asthma quality measures by:

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Table 4 Example of Emergency Department (ED) Medical Resource Utilization Output*

Adult Population	Plan†		Reference‡	
	Persistent No. (%)	Non-Persistent No. (%)	Persistent No. (%)	Non-Persistent No. (%)
Members with asthma	2,987	12,809	67,194	250,528
Asthma members with asthma-related ED visit	124 (4%)	117 (1%)	6,171 (9%)	5,043 (2%)
Total number of asthma-related ED visits	159 (100%)	131 (100%)	8,714 (100%)	5,731 (100%)
Prescription claims 30 days prior to event	259 (47%)	146 (77%)	10,868 (42%)	3,600 (68%)
Controller medications	68 (26%)	41 (28%)	4,309 (40%)	766 (21%)
Adrenergic bronchodilators	8 (12%)	5 (12%)	393 (9%)	64 (8%)
Formoterol	0 (0%)	0 (0%)	52 (13%)	11 (17%)
Isoetharine	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Levalbuterol	3 (38%)	3 (60%)	108 (27%)	21 (33%)
Metaproterenol	0 (0%)	0 (0%)	28 (7%)	1 (2%)
Pirbuterol	3 (38%)	0 (0%)	56 (14%)	16 (25%)
Salmeterol	2 (25%)	2 (40%)	149 (38%)	15 (23%)
Anticholinergic bronchodilators	6 (9%)	6 (15%)	290 (7%)	71 (9%)
Bronchodilator combinations	21 (31%)	10 (24%)	1,290 (30%)	263 (34%)
Inhaled corticosteroids	19 (28%)	14 (34%)	614 (14%)	177 (23%)
Leukotriene receptor antagonists	14 (21%)	5 (12%)	1,336 (31%)	169 (22%)
Mast cell stabilizers	0 (0%)	0 (0%)	31 (1%)	4 (1%)
Monoclonal antibodies	0 (0%)	0 (0%)	36 (1%)	0 (0%)
Xanthines	0 (0%)	1 (2%)	319 (7%)	18 (2%)
Rescue medications	191 (74%)	105 (73%)	6,650 (60%)	2,824 (79%)

• The percentages above may not sum to 100% due to rounding of whole numbers.
• The data presented within this table are aggregate data.
• The sum total of the number of medications prior to an event (Controller + Rescue) may or may not be equivalent to the total number of members with medication prior to an event, as patients may have a claim for more than 1 (one) medication prior to a subsequent event.

* Patients are defined as having persistent or non-persistent asthma based upon HEDIS 2007, Vol 2. National Committee for Quality Assurance.[7]
† Plan = Plan-specific data uploaded by the managed care organization.
‡ Reference = PharMetrics data preloaded with the AURA tool.

- determining patterns of resource utilization through customizable metrics to gain an understanding of factors that affect asthma care for patients, prescribers, and health plans.
- displaying plan-specific results compared with national or internal benchmarks to help monitor and guide quality-improvement initiatives.
- helping to identify cost drivers of care from a payer's perspective.
- guiding health plans in quality-improvement initiatives to optimize the use of asthma medications.

HOW HEALTH PLANS CAN USE AURA TECHNOLOGY

For health plans, AURA provides a comprehensive approach to measuring and optimizing asthma management. With the ability to use national and plan-specific references, patterns of usage can be tracked chronologically to allow for easier monitoring of quality performance metrics at the plan, provider, and patient levels. Tracking medical and pharmacy costs through AURA also enables technicians to target high users of resources, to evaluate the effectiveness of interventions, and to measure the impact of decisions concerning coverage of formulary drugs. AURA also provides users with customizable

metrics for analysis and automated key reports to facilitate the implementation and analysis necessary to improve asthma care.

An asthma research collaboration is under way to implement AURA to measure trends and to identify quality-improvement opportunities within various health care organizations. Aggregate results from the collaboration are being used to validate performance benchmarks among MCOs.

LIMITATIONS OF AURA TECHNOLOGY

AURA is limited by the accuracy of the data that are imported by each organization. Although a data request form is provided with the software tool, users may choose to depart from the instructions described in the form. Consequently, results should be interpreted in light of the actual patient population and claims analyzed. Departures from the data request form may also render comparisons with the default PharMetrics references invalid.

AURA is also limited to an analysis of prespecified utilization measures. Although AURA captures the key measures of resource utilization in asthma (e.g., emergency and outpatient visits, hospitalizations, compliance with medication regimens, use of SABAs and steroids), any new measures of interest would not be captured by the tool without reprogramming the software.

CONCLUSION

Managing asthma can be challenging and costly. Innovative technology that can assist in detecting ways to improve and streamline a population-specific approach to care would prove invaluable from both a health and an economic standpoint.

AURA technology allows health plans to evaluate key utilization outcome measures to optimize asthma treatment, which can lead to improved patient health, more appropriate use of medications, and reductions in the overall cost of asthma care.

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